

Joint FAIR ECE 19 and ECSG 10 Meeting

Chair: Christos Touramanis & Jens Dilling

April 18 & 19 2024 at GSI and on-line



Finland



France



Germany



India



Poland



Romania



Russia



Slovenia



Sweden



UK



Czech R



GENERAL

- **Very impressive progress on construction!** And **congratulations** to the team for the 'phase-transition' to moving equipment and systems into the buildings.
 - Magnets and power systems are showing up and it looks like an accelerator facility, this is great!
 - The committee was treated to a tour. Very impressive and good to see.
- Moving towards commissioning on many fronts:
 - 2028 will be the start of operation and science pillars are getting ready and are on track.
 - **Great to hear about the new FAIR Fellow and Associate Program.** This is very welcome and can make a big difference for the science programs which are starting soon with commissioning. Take an active approach in finding and assigning strong candidates!
- **Phase 0 continues to be a big success.**
 - Needed for science output, training of the next generation, and being ready for FAIR in 2028 ES/FS.
- We **strongly encourage continuation of opportunistic science exploitation**, if and where possible, including experiments to be done at alternative ('not final') locations. BUT: **Stay focused!**
- Steps towards MSV are needed in the near future (~2025/26) and **critical decisions about the right balance of science and construction are urgently needed.** This is something that FAIR management should drive in concert with the community.
- FAIR management is undergoing some changes, and it is imperative that critical and timely decisions are not delayed and continuation of processes in the meantime are ensured.

TDR approvals

- NUSTAR
 - Recommend approval: Addendum PAS 2.22
 - R3B TRT 2.26: Sub committee formed, recommendation through email when report available.
- APPA
 - BIO MAT TDR 3.41 & 3.42: Recommend accepting subcommittee report however no final recommendation from the committee yet. Requires more discussion on general implication for overall facility. This can be done by email.
- Computing CDR 0.03: Sub committee is endorsed, and they are working on the report. Recommendation of final report can be done by email.

NUSTAR close out

14:00


Welcome & Introduction

14:10

NUSTAR Overview

(25' + 10' discussion)

Speaker: Zsolt Podolyak (???)

 ECE19-ECSG10_NU...

14:45

NUSTAR Project Status

(25' + 10' discussion)

Speaker: Helena May Albers (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))


 NUSTAR_ECE_18Ap...

15:20

NUSTAR Finances and MoU

(25' + 10' discussion)

Speaker: Alexander Herlert (FAIR)

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ECE/ECSG Panel:

P. Bednarczyk, A. Gade, K. Hahn, A. Roy

Thanks for the great presentations and the frank discussions!

General comments

- The committee was very impressed with the excellent science program that the NUSTAR collaboration has been performing in the framework of FAIR Phase 0
 - Ran 103 days (SIS18) and 94 days (UNILAC) in 2021 & 2022
 - First results published
 - Phase 0 is restarting in 2024 after zero time for experiments in 2023
 - NUSTAR expertise and instruments were used for developments in hadron therapyFAIR Phase 0 continues to be of great importance for the NUSTAR team and FAIR
- The committee acknowledges the complexity of NUSTAR's planning efforts for Early Science due to the required coordination with facility and SuperFRS installations. The committee commends the collaboration for the thoughtful planning that has already started. We endorse NUSTAR's effort to prepare for the first NUSTAR FAIR experiment in 2027 by (i) pushing the SIS18 intensity and (ii) obtaining historical GSI data on SIS18 beam intensities and their sustainability over the period of an experiment to plan for the first experiment with the highest impact and lowest risk
 - The committee encourages FAIR operations to work with the NUSTAR team on optimizing the chances of a high-impact, low-risk first experiment


- A document prepared by NUSTAR was submitted to the ECE/ECSG in October 2023, outlining details of the technical planning for Early and First Science. A comprehensive evaluation was carried out by NUSTAR of the infrastructure that will be available in the Early and First Science stages of FAIR when the S-FRS high-energy branch and the NUSTAR High Energy Cave will be fully commissioned and ready for experiments. The planning optimizes the use of the available resources to maximize the scientific output of FAIR. In conclusion, the ECE re-emphasizes that equipment, formerly planned for the low-energy branch, such as DESPEC, shall be installed and operated at the HEB, to maximize the scientific opportunities offered at FAIR.

Findings and comments

- The Committee appreciates the risk mitigation in place for the poor resolution of CEPA within CALIFA and acknowledges the progress made on the other two highest-risk items presented
- The Committee congratulates NUSTAR to the near-completion of the Construction MoU. The Committee is satisfied with the documents and supports finalizing the main text of the MoU before the upcoming RRB meeting, in anticipation of signatures from the funding agencies
 - The Committee appreciated the fact that some members, e.g. UK and Germany, have already paid part of their fraction to the common fund
 - The Committee is looking forward to the Operations MoU in the future

We are pleased to confirm that we have seen the latest MoU version submitted to the RRB for this meeting, and we strongly recommend to the Funding Agencies to sign the document.

Break out session APPA: Theory Seminar room SB3 3.170a


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14:00 **Welcome & Introduction**

14:10 **BIO Progress Status**

(20' + 10' discussion)


Speaker: Prof. Marco Durante (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

 BIO-ECE19.pptx

14:40 **Status Report MAT**

(20' + 10' discussion)

Speaker: Maria Eugenia Toimil Molaes (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

 News_from_MAT_A...

15:10 **Status Report HED@FAIR**

(20' + 10' discussion)


Speaker: Stephan Neff (Facility for Antiproton and Ion Research In Europe GmbH(FAIR))

 StatusReport-ECE-H...

15:40 **Progress of SPARC Activitles towards FAIR ES-FS**

(20' + 10' discussion)

Speaker: Angela Bräuning-Demian (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

 SPARC_Status_ECE...

APPA: panel:

Ladislav Půst, Marc Weber,
Henning Schmidt, Paul Scheier

General comments

- All the APPA teams are affected by the new timelines postponing the APPA programs. However, all groups face different challenges and mitigate the situation individually.
- All APPA teams have clear visions and strong spirit to adapt to the current situation
- APPA has very strong science programs to offer early to user communities
- There are strong efforts by all the teams in both the phase-0 science and the preparations for FS/FS+
- The ability to continue the activities at the phase-0 facilities is essential to all the teams
- Congratulations to three ERC grants dedicated to APPA; this sends a strong message about the competitiveness and excellence of their science

Specific comments and findings - BIO

- The BIO team presented impressive recent results in tumor irradiation, space medicine, vaccines, etc.
- Very successful in research grants (new ERC grant and large collaborative Marie Curie Actions grant)
- The Biophysics Collaboration will continue to use Cave A and Cave M for the experiments with beams from SIS18 in the ES/FS/FS+ phases
- The Biophysics Collaboration is considering combining/optimizing ES/FS/FS+ experiments. This will achieve the objectives of the FAIR-day-1 scenario, but will require to use two new locations: the ring branch of S-FRS and the CBM Cave.
- The BIO team considers the use of both radioactive beams in S-FRS and the high-energy beam for Cosmic Ray irradiations in the CBM Cave.
- Proposed collaborative use of S-FRS and the CBM Cave in the FS+ Phase is a win-win solution and should be strongly considered. It requires careful coordination and planning to avoid unintended consequences.

Specific comments and findings - MAT

- Great collaborative projects with many user groups.
- The MAT Collaboration will continue to use existing stations at UNILAC and SIS18, including the MAT-station with beams extracted from the CRYRING.
- The existing MAT beamlines are flexible, equipped with several in-situ techniques which are mobile and can be attached to the future MAT station at FAIR
- The MAT collaboration is considering to combine/optimize the ES/FS/FS+ experiments, reaching the objectives of the FAIR-day-1 scenario, by using temporarily the S-FRS target station, with the CBM Cave as backup station
- Proposed collaborative use of S-FRS and the CBM Cave in the FS+ Phase is a win-win solution and should be strongly considered. It requires careful coordination and planning to avoid unintended consequences.

Specific comments and findings – HED

- HED is strongly affected by re-prioritization
- HED is considering new approaches to maintain impactful science program, including opportunities at existing facilities.
- New initiatives were presented to explore inertial fusion, both based on existing Phelix laser and with new laser systems.
- A new concept of constructing a laser building attached to the APPA Cave by a commercial company was presented. We encourage FAIR management to evaluate this promising concept, which could be beneficial for the science community.

Specific comments and findings – SPARC


- The FAIR phasing strategy defines the SPARC research opportunities for the coming 5 to 8 years around the existing GSI / MSV facilities: ESR, CRYRING@ESR and HITRAP, and at SIS100 within FS window.
- Effort to improve, upgrade, and retrofit these facilities to maximize scientific benefit of future experiments are planned.
- SPARC concentrates on extensive operation of the existing components and achieved impressive scientific output. Concerns were expressed with regards to regular beamtime availability, which is needed to achieve FS goals.
- The SPARC collaboration made good progress in the completion of components and already has a large portfolio of new, & advanced instrumentation.
- Vibrant community, significant interest, and exciting science associated with HITRAP.

Recommendations.

- **BIO and MAT:** Temporary collaborative use of the S-FRS and the CBM Cave should be strongly considered by the FAIR Management. This would include funding, logistic support to enable coordinated and optimized collaborative use of these temporary areas and consideration for optimal beamtime in coming years.
- **SPARC** research is thriving in spite of limited beam time access. We recommend to FAIR management to consider opportunities to provide more beam time, if possible.
- We encourage **HED** to continue the effort to mitigate situation, and consider synergetic and opportunistic solutions.
- In the case that the APPA Cave is used in intermediate time otherwise, then such use should not prevent timely installation of equipment for the FS++ phase.

PANDA

Break out session PANDA, KBW 2.28


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14:00 **Welcome & Introduction**

14:10 **PANDA News and Progress**

(15' + 5' discussion)


Speaker: Klaus Peters (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

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14:30 **PANDA Technical Status**

(45' + 5' discussion)

Speaker: Lars Schmitt (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

 lschmitt_panda_EC...

Frank Hartmann & Jens Dilling

- We like to thank the group for the open discussion
- The progress is visible and commendable but also the constraints are obvious to committee members and to the collaboration

General comments

- The PANDA collaboration is working hard on defining a path forward and have continued developments and concepts.

- **Cluster Jet Target:**

- completion in 2024 apart from gas system
- continue operation with beam to preserve know-how and optimise

- **MVD:** work on strip barrel, ToASt ASIC tested at FZ Jülich, one more iteration

- **STT:** 1 sector in 2024/25, all straws produced, electronics pre-series ready (M8)

- **Barrel DIRC:** Pre-series barbox till end 2025, 35/165 PMTs delivered and accepted

- **Forward Tracker:** FT1/2 ready end 2025, FT3/4 end 2027, 39/184 modules built, commission with sources/cosmics, electronics as for STT, prototype planes at HADES

Findings and comments

- **Lots of developments and progress in certain areas**, including assembly with funding and personpower committed.
 - Like Forward Tracker, Barrel EMC mechanics
- **Some orphaned system remain** – this is a worry
 - No resources to participate in necessary R&D and design/engineering work
 - Need new parties
 - **Outer Tracker:** transported to GSI in summer 2023, usage for various applications in discussion
 - **Forward Endcap EMC:** partial assembly done at FZJ, COSY beamtime done summer 2023, final assembly and intermediate program planned at ELSA (Bonn)
 - **Backward Endcap:** assembly complete spring 2024, beam at MAMI A1 from 2024
 - **Barrel EMC:** first slice ready, preparation of readout for characterisation, submodule tests
 - **Luminosity Detector:** Final detector till end 2025, tests in KOALA setup planned
 - **Orphaned Systems:** MVD Pixels, GEM Tracker, Barrel TOF, Disc DIRC
 - **Russian Systems:** Muon System, Forward TOF, FS Calorimeter, Forward RICH

Findings and comments

Barrel EMC: Reduced Radius

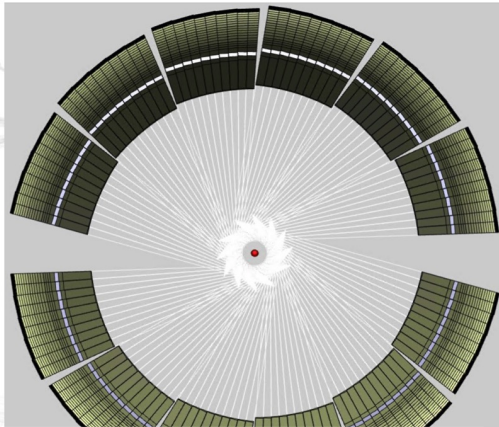


Barrel EMC with 12+2 slices
r=432 mm: 12x10 crystals

12 original slices with 710 crystals
2 special slices left out for
diagonal target pipe

Simulation studies started at U Bonn
with PANDARoot (B. Salisbury)
to evaluate losses:

- Photon gun at various energies
- $\eta\pi^0\pi^0 \rightarrow 6\gamma$



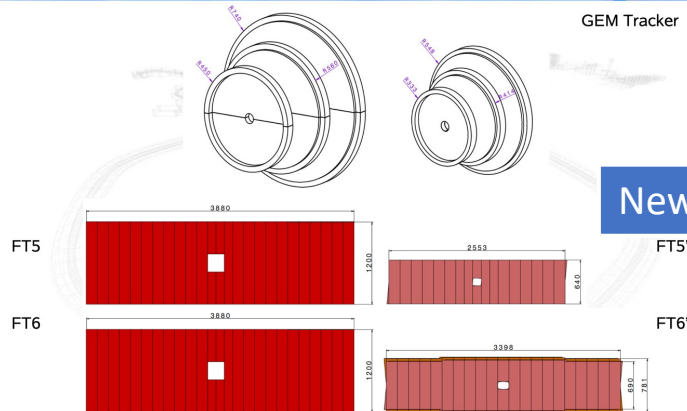
Use same mechanics structure at smaller radius



Compact Setup: Tracker Comparison



GEM Tracker



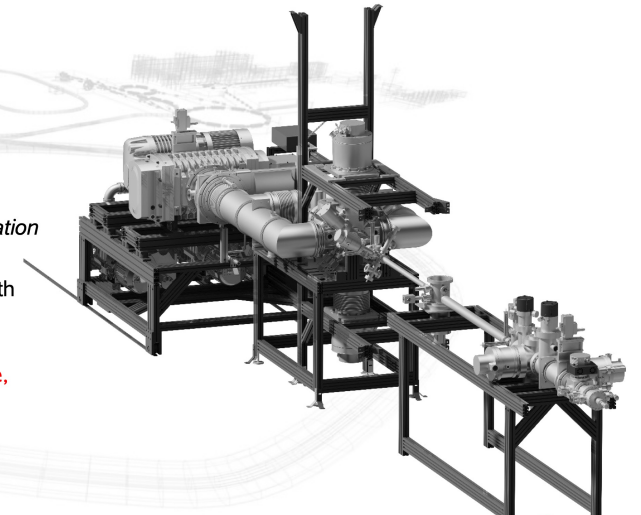
New GEM concepts



Cluster Jet Target



- PANDA Cluster Jet Target not for ZEUS:
 - Vertical forces required for sealing and precision positioning, impossible to adapt
 - Large mechanical modifications
 - No droplet generation, pellets
 - Long years of optimisation
- Münster Prototype Cluster Jet Target in close to PANDA geometry: *horizontal operation*
- Koala Cluster Jet Target: new construction with simple setup, *horizontal operation*
- Horizontal operation of simpler target possible, tilted operation will not work (no well defined adjustment plane)
- Optimisation needed, $< 10^{15} \text{ cm}^{-2}$ possible



Clear finding that tilted operation would not work
Horizontal operation will decrease luminosity by factor 10
→ hit physics program
NB. Vertical operation would not work with ZEUS magnet

We commend the work done on adapting a compact design.

Summary

Important to get a clear perspective and plan: urgently needed to retain collaboration members and attract new parties.

- Consider to secure COSY ring (and store it). This would send a positive sign and could save costs with respect to RESR ring.
- Estimate (approximately) the loss of physics impact by using the ZEUS magnet, including the horizontal operation of the cluster target.
- Continue with vigour the option of available superconductivity cables and implication of building a magnet with the geometry to operate a vertical target injection.
- The committee is concerned with remaining risk items: Magnet, Barrel Crystals, orphaned systems

Reiteration of former recommendations

- Implement the “compact” geometry and baseline assumptions for detector technologies/designs in MC and estimate precision/reach for a couple of “golden channels” for the first 5 years of beam
- Create a strawman detector completion timeline with milestones.

CBM Breakout Session

T. Gunji, L.Musa, A. Sharma, C. Touramanis, C. Williams

Break out session CBM, BK1, 4.019 & 4.020

 zoom_cbm.pdf

14:00

CBM Collaboration Status

(20')

Speaker: Norbert Herrmann (Ruprecht-Karls-Universität Heidelberg)

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14:20

CBM Technical Status

(45')

Speaker: Piotr Gasik (GSI/FAIR)

 gasik_ece_ecsg_apr...


 milestones_Apr202...

15:05

Update on C-MoU Addendum

(15')

Speaker: Jürgen Eschke (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

 Amendment to the ...

 CBM-Construction-...


 Report ECE meeting...

15:20

TOF Ageing Studies, PRR Status

(20')

Speaker: Ingo Deppner (Ruprecht-Karls-Universität Heidelberg(U_HD_PHYS))

 deppner_ECE_Apr2...

15:40

Update on CRI2.0

(10')


Speakers: David Emschermann (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

15:50

Update on MVD Timeline

(10')

Speaker: Auguste Besson (IPHC - Strasbourg University)

 MIMOSIS_Status_E...

Finding and comments

- We were pleased to learn of Prof. Tetyana Galatyuk's election as the CBM Collaboration Spokesperson, a distinguished figure in the field of nuclear matter at high baryon chemical potential. We wish Prof. Galatyuk success in her new role and look forward to working with her. We also wish to express our strong appreciation to the outgoing spokesperson, Prof. Norbert Herrmann, for his achievements during his term and his excellent collaboration with the ECE and ECSG.
- The CBM heavy-ion program is uniquely poised to explore the high baryon chemical region of the QCD phase diagram, aiming to delineate the onset of deconfinement, directly observe the first-order transition, and locate the critical endpoint. We note that CBM at FAIR will be the only experimental facility capable of achieving the objectives outlined above within this decade. The status of the CBM program as an international priority project was reaffirmed in the 2023 US Long Range Plan for Nuclear Science, and it is currently being discussed as such in the ongoing 2024 European Long Range Plan NuPECC process. In this regard, we underscore the importance of ensuring that the FAIR strategic roadmap includes the start of the CBM program by the same year.
- We note that the ability to complete the construction and commissioning of the CBM detector by 2028 depends on a series of timely decisions to be made by the Council regarding the funding for technical infrastructures or CBM detector components. This includes decisions on funding for the 'Technical Building Infrastructure', which need to be made by the end of 2024 in order to avoid delaying the start of CBM. Moreover, a timely completion of 'Road/Crane' by Q3/Q4 2024 is required to continue with CBM Common Infrastructure installation which is crucial for the Magnet components installation in mid 2025.

Finding and comments

- The committees were impressed by the significant progress the collaboration has made on all fronts - organizational, technical, and scientific. We commend the team on their positive attitude and resilience in dealing with the uncertainties that challenge a timely start to FS+.
- We note that uncertainty regarding the funding for completing the infrastructure necessary for FS+ may also postpone the in-kind contributions to the construction of CBM detector components. For instance, the CBM management has reported that Romania has indicated that the funding for producing the TRD 2D chambers will be on hold until the Council approves the TBI funding.
- The collaboration has defined a Reduced Scope Version by limiting the solid angle coverage for the initial beam runs. Given the initial commissioning and optimization period with the first beams, this option does not significantly impact the science in the first year. Moreover, this strategy enabled university groups to secure funding for the period 2024-2027. We commend the collaboration for developing this approach.
- The Committee acknowledges the comprehensive list of milestones provided by the CBM collaboration, along with the updates presented to us one week prior to the review meeting. We appreciate the CBM collaboration's commitment to this process and request that it be maintained.

Finding and comments

- The collaboration presented **great overall progress in the development and testing of all systems**. Most systems have no remaining concerns and final designs are available, going to PRR and production soon.
- The committees were pleased to learn that the **CBM magnet contract has now been placed** and work has commenced. The production schedule anticipates the site acceptance test (SAT) for September 2026.
- The committees are impressed by the work the TOF group is undertaking to study the aging effects and the enhancements achieved with pad spacers and the forced flow of gas between the glass plates.
- MVD: Testing of MIMOSIS-2 has revealed unexpected issues. After a retrofit of the circuit using a low-energy ion beam, the CBM team was able to identify and confirm three issues. The production of an updated version, MIMOSIS2.1, which aims to correct two of the three identified errors, is on track. The last issue - a significant jitter in the PLL that compromises robust data transmission - remains unresolved. A backup solution is under exploration; however, this may result in additional delays.

Finding and comments

- The collaboration provided an update on the CRI2.0 board and discussed the option of choosing between the in-house-developed CRI2.0 interface and variants of the FLX designed by Brookhaven for ATLAS, outlining the advantages and disadvantages of each. While adopting the board developed for ATLAS may offer performance benefits and reduce the expert resources required for completing the CRI design, the FLX board developed by BNL is subject to export restrictions. This limitation implies that it might not be exported to some of the CBM collaborating institutes involved in the detector construction.

Summary

- CBM has a credible plan for completion first beam data acquisition by the end of 2028. This plan is critically dependent on funding decisions to be made in 2024, which are necessary for the completion of detectors and the CBM beamline infrastructure. Any postponement in these decisions could result in a delayed start to CBM science, jeopardizing the health of the collaboration and the integrity of the science program.

Summary

- The collaboration presented an amendment to the construction Memorandum of Understanding (C-MOU) to address the shortfall of €0.7 million in contributions from Russian institutes, as well as an additional €0.3 million due to cost escalation from increased construction time and inflation. They propose extending the C-MOU payments for an additional two years, aligning with the postponed start of exploitation and the corresponding Maintenance & Operations Memorandum of Understanding (M&O MOU), thus covering the financial shortfall. The committees consider this an appropriate and equitable proposal and recommend its approval.
- The collaboration must decide on the readout interface, choosing between the in-house-developed CRI and variants of the FLX designed by Brookhaven for ATLAS. We recommend that the collaboration urgently engage with BNL management and the DOE to determine if exceptions to US export controls can be granted, permitting the temporary use of this system in countries where CBM collaborating institutes need the readout interface board to carry out construction and maintenance activities. Should these exceptions not be obtainable, we advise that the collaboration prioritize the development of the CRI